I have transmitted from South Australia, one common system of orthography has been adopted; and that the different writers of the vocabularies, having previously agreed upon one common method of representing sounds, has rendered these records much more complete and valuable than they would otherwise have been.

V.—*Some Remarks upon the Freezing of Streams in North America, in connexion with the supposed Congelation of their Sources in High Latitudes.* By ALEXANDER C. ANDERSON, H.H.B.C.S.

AT the Newcastle meeting of the British Association, Captain Washington, upon reading Professor Von Baer's communication respecting the frozen ground of Siberia, made allusion to an adventure of the Baron Wrangel's, near Yâkutsk;* and inferred that the members of the Hudson's Bay Company must, in their frequent journeys, have encountered similar adventures, tending to the same conclusion—namely, the freezing of the sources even of considerable streams, in high latitudes, during the winter season.

Though far from seeking to invalidate Baron Wrangel's statement, I cannot but think that the inference deduced from it is incorrect. Circumstances nearly similar (though on a far less conspicuous scale) have occurred to myself and others who are in the habit of travelling during winter in this country; but every instance that I have met with or heard of may, I conceive, be referred to the following simple explanation.

But it is first necessary that attention be directed to the process by which the congelation (for it can scarcely be termed freezing) of rapid streams is effected. To this end, wherever the current runs with any considerable velocity, it is first necessary that the stream become choked with drift ice, first formed in the slack water near the banks, and afterwards disengaged and driven away by the current. Dense packs are thus at length formed; and these, being stopped in different parts by the projecting angles of the shore, are soon consolidated by the cold into a firm and stationary mass; with occasional vacancies, however, owing to the unequal obstruction of the packs. These openings, though in process of time their dimensions become much contracted, are kept from closing by the rapidity of the current, even when the cold is very severe. Were it not for the packs formed and ar-

* See 'Narrative of an Expedition to the Polar Sea.' By Admiral F. Von Wrangel. Edited by Lieut.-Col. Sabine, R.A., F.R.S. 2nd edition, p. 36.—ED.

rested as we have explained, the agitated waters would be maintained open throughout; a fact evinced by the circumstance that, even in very high latitudes, some streams—such as the Bear's Lake River, instanced by Dr. Richardson—are never frozen: not, as that gentleman supposes, on account of their rapidity solely, but simply because their course is too short, as compared with the breadth, to permit a sufficient accumulation of drift-ice to occasion a stoppage. For this reason the upper parts of rivers (setting the consideration of springs apart) are never congealed from side to side above the spot where the accumulation of drift first chokes the passage. Under the concurrent circumstances which I have stated, it may be assumed as a general truth that no stream is too rapid to admit of congelation; and the only observable difference between the most rapid streams and those of more moderate velocity, is that the former present an extremely rugged surface, owing to the forcible protrusion of huge blocks of ice during the first obstruction of the packs; while that of the latter is comparatively level, on account of the smaller degree of force exerted against the component blocks by the current. The existence of these *bourdignons*, as the Canadians term the rugged projections upon the ice, is, I may remark, a very serious impedient to the traveller's progress upon the surface of rapid streams.

To proceed more directly to the point under consideration. The obstruction of the packs in any particular reach of a river necessarily causes a temporary retardation of the current; by which the water in the superior vicinity is raised, for a short period, perhaps 4 or 5 feet, or even more, above its previous level. In some positions the body of ice acquires sufficient firmness before the subsidence of the waters to maintain its position under these circumstances; but this occurs, I am inclined to believe, only upon small streams, or upon the minor channels of large streams. Some of the latter, being filled upon the rise of the water, are again reduced to their previous state of partial or total dryness as soon as the superfluity is drained off by the main channel. Now it is easy to conceive that, in the interim, the accumulation of drift might, in severe weather, be rendered so compact as to maintain its position over a narrow surface at the greatest height to which the water had risen. Possibly, too, under the intense cold of extreme latitudes, a large stream might become in like manner bridged over, and retain its elevated position under the same circumstances. But in all cases of this description which have come under my knowledge, the weight of an unsupported mass of any considerable breadth occasioned it invariably to subside as the waters retired: and, indeed, to judge by analogy from the construction of artificial bridges, it seems to be evident that no

perfectly flat surface of any great breadth can sustain its own weight with no other support than that afforded at the sides.*

Upon small streams, I may add, more especially in mountainous positions, the like effects are sometimes produced by their being frozen at a time when they are flooded by previous thaws, which not unfrequently occur in the autumn. In such cases, as soon as the superfluous waters run off, the ice is found to be in like manner elevated proportionably above the surface: nay, in some instances of extremely insignificant brooks, whose sources are quite superficial, a total desiccation of the waters may ensue. But in ordinary streamlets I never witnessed this to take place.

Under one or the other of these views, may it not be supposed that Baron Wrangel must have chanced to alight either upon a stream circumstanced as that last described, or upon the drained small ana-branch of a larger stream? The latter supposition is the more probable, since the scene of the Baron's adventure is described as a "large river;" a shallow offset of which might, as I trust I have shown, and as I have sometimes witnessed, have been easily drained, either partially or totally, without implying the failure of the usual supply in the main channel, or the congelation of the sources.† This view of the subject, moreover, derives support from the fact that the strength of the ice was evidently insufficient to bear the weight of a loaded horse; and it is therefore scarcely credible that a flat surface of any considerable extent, possessing no greater tenacity than this appears to have had, could have sustained its own unsupported weight. It should be borne in mind, too, that ice from which the water has retired is invariably weaker than that which rests upon the surface, not merely on account of its being deprived of the support afforded by the water, but in point of actual tenacity. Schoolboys at home, for this reason, term it "cat's ice."

Under the impression that this exposition of Baron Wrangel's adventure will tend to discountenance the inference that the sources of streams of any magnitude are affected by the external temperature, I shall hazard some further remarks upon subjects which may be presumed to bear indirect reference to the existence of perpetual ground-ice.

The open spaces occurring upon the frozen surfaces of rivers

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* The author is perfectly right, if the surface be indeed *flat*, *i. e.*, horizontal; but large and rapid rivers are known to have a convex surface, and if the icy covering assumes this form, it may, as in the case of what are termed flat arches, bear not only its own weight, but a considerable addition to it without breaking.—Ed.

† I would with much deference suggest that the mere supposition of this congelation involves a physical impossibility; for it ought, perhaps, to be inferred that the subterranean waters, from whatever cause they may be generated, if thus imprisoned, would probably occasion effects equal to those of confined gunpowder, or of a pent-up volcano.

are by the Canadians termed "*mares;*"* a name applied likewise to another variety of these openings, whose origin is in reality very different, though upon superficial observation the two are apt to be confounded. The latter variety is generally—I ought perhaps to say invariably—met with at the outlet of lakes, or at the spot where a tributary enters; and frequently in deep sluggish streams and other positions where the exciting causes similarly prevail. Subaqueous springs are in these (last?) cases the obvious cause. These "*mares,*" or pools, though perfectly quiescent, are not affected by the most intense cold, if we except that, upon the protracted continuance of severe weather, their dimensions are somewhat contracted; but upon the relaxation of the cold, they quickly recover their former size. Indeed the "*mares*" occupy a conspicuous place in the natural economy; since Providence, in his bountiful care, has thus secured to the inhabitants of the waters the source of a constant renewal of the atmospheric air—another beautiful exemplification of that adaptation of means to ends which pervades the works of the Creator.

Hence it appears that springs are, in these latitudes, endowed with a certain average degree of temperature, which is adequate under all circumstances to prevent the speedy congelation; and the common hydrostatic law of course secures a constant renewal of the freshly-emitted water at the surface during winter. Unfortunately, owing to my having had the misfortune to break the only thermometer to which I had access, I cannot state with precision the temperature of the springs. In the Rocky Mountains, from lat. 50° to 55°, where the mean annual temperature is comparatively low, the phenomenon is even more conspicuous than in more genial positions lying at a lower level: and in crossing these mountains between the heads of the Athabasca and Frazer's River, at different times, from October to February, of several years, I have witnessed the "*mares*" in their usual condition, whether under the influence of the early frosts, or when subjected to the intense cold of mid-winter. A remark which has also been made by other travellers in more northerly parts.

It may, therefore, be inferred that, if perpetual ground-ice exists in these localities, all streams of any magnitude must have their origin below the frozen stratum; and likewise that the veins of water must possess a considerable degree of heat in their first state, or gush up with a velocity adequate to prevent any material refrigeration during the ascent. On the other hand, any streamlet that ceases to flow during winter must obviously derive its supply from land-springs.

I have been unable to ascertain any point directly connected

* French word signifying a pool.

with the existence of perpetual ground-ice, which doubtless exists in the northern parts of America as well as in Siberia. In Western Caledonia, the most northern position in which I have resided permanently, the mean annual temperature is considerably above the freezing point. Although in a pretty high latitude, it shares, in common with all positions on the W. side of the Rocky Mountains, perfect immunity from protracted cold. In this vicinity, therefore, the ground is never permanently frozen at any depth to which I have had access, either by digging or on inspecting the landslips that are occasionally formed.

VI.—*Notes on African Geography; communicated by* Mr. MACQUEEN.

I. *Visit of Lief Ben Saeid to the Great African Lake.*

LIEF BEN SAEID, apparently a very intelligent man, about forty years of age, and born in Zanzebar, of the Manmoise * tribe, states he has been twice at the Great Lake in Africa, for the purpose of bartering for ivory, and describes his last visit as follows.

He left Zanzibar in the month of September, 1831, and landed at a town called Boramy,† on the African main, situated a little to the southward of the south end of Zanzibar. After remaining there for some days, he left with a caravan, or kafila, of about five hundred persons. He had about seventy of his own followers; the rest consisted of returning Manmoises. The first day he travelled a distance of about 9 miles, on a plain road, where, at half that distance, they crossed a small river called Mazinga.‡ Putting up at the village of Qua, which is the principality of a tribe called Mazeamoo.§ The next day travelled, about the same distance, to Beonee;‖ and the next day to a village called Ma Kunda ¶ —during this journey crossed over a hill: next stage arrived at Konjee, and then at Moktanero, near which is a river about 200 yards broad, infested with alligators and hippopotami. The next night slept at Deejamora; the next stage passed under a high range of hills without vegetation, the road being sand, and which has been the case from the time they left the coast; passed Kedonda, and slept at Onegata, where two large rivers join; slept at Datomee. Passing between two high hills at this place there is another tribe called Koto.** Again slept at Zohgomero, where

* Mono-moézi.—ED.
† Buro-maji, Buro-water.—ED.
‡ The name Mazinga may be correct, but it is nevertheless to be suspected, since the tract described is inhabited by the Mazingea.—ED.
§ Mozimo.—ED.
‖ Bióni.—ED.
¶ Macunda.—ED.
** N'cutu.—ED.